

CLAIMS

1. A turbine blade comprising:
a hollow airfoil joined to a supporting dovetail at a platform;
said airfoil including pressure and suction sidewalls joined together at chordally opposite leading and trailing edges, and extending in span between a root at said platform and an outer tip; and
said airfoil further including a leading edge cooling circuit behind said leading edge having a radial first coolant inlet commencing in the base of said dovetail, a trailing edge cooling circuit in front of said trailing edge having an axial second coolant inlet commencing in the aft face of said dovetail, and a middle cooling circuit disposed between said leading edge circuit and trailing edge circuit, and having a radial third coolant inlet commencing in said dovetail base between said first and second inlets.
2. A blade according to claim 1 further comprising a sealing wing extending aft from said platform above said second inlet for directing coolant flow into said second inlet.
3. A blade according to claim 2 wherein said dovetail is sealed closed at said base below said second inlet and aft of said first inlet in said base.
4. A blade according to claim 3 wherein said second cooling circuit extends through said dovetail to said base and is sealed closed at said base by a plate fixedly joined to said base.
5. A blade according to claim 3 in combination with a rotor disk having a dovetail slot in a perimeter rim thereof in which said blade dovetail is mounted for defining a turbine;
said turbine further including a forward blade retainer mounted on a forward side of said disk rim, and an aft blade retainer mounted on an aft side of said disk rim to trap axially therebetween said blade dovetail; and
said aft retainer terminates below said second inlet.

6. A turbine according to claim 5 wherein:

 said disk further includes a thinner web extending radially inwardly from said rim to a thicker hub having a center bore;

 said forward retainer is spaced from said web to channel a first-pressure coolant to said dovetail slot for flow into said dovetail first inlet; and

 said aft retainer seals closed said dovetail slot along said disk rim to contain said first-pressure coolant inside said dovetail slot.

7. A turbine according to claim 6 defining a first turbine in combination with a second turbine spaced aft from said first turbine to form an aft cavity therebetween for channeling a second-pressure coolant along an aft face of said first turbine disk to said second inlet.

8. A turbine combination according to claim 7 wherein:

 said second turbine includes a row of second rotor blades extending outwardly from a rim of a second rotor disk; and

 said second rotor blades include a sealing wing extending forward to effect a rotary seal with said sealing wing on said first turbine rotor blade.

9. A turbine combination according to claim 8 further comprising:

 first means for channeling compressor discharge air through said forward blade retainer for flow through said first coolant inlet; and

 second means for channeling compressor interstage bleed air to said aft cavity between said first and second turbines for flow through said second coolant inlet.

10. A turbine combination according to claim 9 wherein:

 said leading edge cooling circuit includes a row of film cooling outlet holes adjacent said airfoil leading edge for discharging said compressor discharge air with a first backflow margin;

 said trailing edge cooling circuit includes a row of trailing edge outlet holes adjacent said trailing edge for discharging said bleed air with a second backflow margin; and

said two backflow margins are within about 1.5.

11. A turbine blade comprising:

a hollow airfoil joined to a supporting dovetail at a platform;

said airfoil including pressure and suction sidewalls joined together at chordally opposite leading and trailing edges, and extending in span between a root at said platform and an outer tip; and

..... said airfoil further including a leading edge cooling circuit behind said leading edge having a radial first coolant inlet commencing in the base of said dovetail, and a trailing edge cooling circuit in front of said trailing edge having an axial second coolant inlet commencing in the aft face of said dovetail.

12. A blade according to claim 11 wherein said dovetail is sealed closed at said base below said second inlet and aft of said first inlet in said base.

13. A blade according to claim 12 further comprising a sealing wing extending aft from said platform above said second inlet for directing coolant flow into said second inlet.

14. A blade according to claim 13 wherein said airfoil further comprises a middle cooling circuit disposed between said leading and trailing edge circuits having a radial third coolant inlet commencing in said dovetail base between said first and second inlets.

15. A blade according to claim 13 in combination with a rotor disk having a dovetail slot in a perimeter rim thereof in which said blade dovetail is mounted for defining a turbine;

said turbine further including a forward blade retainer mounted on a forward side of said disk rim, and an aft blade retainer mounted on an aft side of said disk rim to trap axially therebetween said blade dovetail; and

said aft retainer terminates below said second inlet.

16. A blade according to claim 15 wherein:

said disk further includes a thinner web extending radially inwardly from said rim to a thicker hub having a center bore;

said forward retainer is spaced from said web to channel a first-pressure coolant to said dovetail slot for flow into said dovetail first inlet; and

said aft retainer seals closed said dovetail slot along said disk rim to contain said first-pressure coolant inside said dovetail slot.

17. A blade according to claim 16 defining a first turbine in combination with a second turbine spaced aft from said first turbine to form an aft cavity therebetween for channeling a second-pressure coolant along an aft face of said first turbine disk to said second inlet.

18. A turbine combination according to claim 17 wherein:

said second turbine includes a row of second rotor blades extending outwardly from a rim of a second rotor disk; and

said second rotor blades include a sealing wing 84 extending forward to effect a rotary seal with said sealing wing on said first turbine rotor blade.

19. A turbine combination according to claim 17 further comprising:

first means for channeling compressor discharge air through said forward blade retainer for flow through said first coolant inlet; and

second means for channeling compressor interstage bleed air to said aft cavity between said first and second turbines for flow through said second coolant inlet.

20. A turbine combination according to claim 19 wherein:

said leading edge cooling circuit includes a row of film cooling outlet holes adjacent said airfoil leading edge for discharging said compressor discharge air with a first backflow margin;

said trailing edge cooling circuit includes a row of trailing edge outlet holes adjacent said trailing edge for discharging said bleed air with a second backflow margin; and

said two backflow margins are within about 1.5.